The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Dick Trevillian, 301-903-3074, or Internet address dick.trevillian@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-09

February 21 through February 27, 1997

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EVENTS

1. CASK MOVEMENT VIOLATES LIMITING CONDITION FOR OPERATION

On February 24, 1997, at the Idaho National Engineering Laboratory Advanced Test Reactor, a crane operator moved a 49,000-pound experiment cask over the top of the reactor without reactor confinement, violating the technical specification limiting condition for operation. A maintenance scheduler reviewing configuration and maintenance tasks in progress identified the violation. Technical specifications require the same confinement conditions for cask movement as those required for reactor operation. The maintenance scheduler attempted to contact the shift supervisor, but he was not available. He then contacted a job supervisor, who was preparing to install another sample that required moving the cask over the reactor, and directed him to stop the installation. Investigators determined that the off-going and on-coming shift supervisors and two on-coming senior reactor operators failed to recognize that reactor confinement requirements were not met. Failure to recognize a technical specification requirement resulted in a violation. (ORPS Report ID--LITC-ATR-1997-0005)

Operations personnel refueled the advanced test reactor on February 18, 1997. Investigators determined that the primary coolant pump covers, which are a part of reactor confinement, were installed on February 20, 1997, to conduct a reactor confinement leak-rate test. Maintenance personnel removed the covers to conduct primary coolant pump run-in testing and did not replace the covers. Investigators determined the shift supervisor was responding to a casualty involving the release of Freon® into the Advanced Test Reactor facility when the maintenance scheduler tried to contact him. (Refer to article 4 for more details).

The facility manager convened a critique to determine the cause of this event. Critique members determined that the off-going and on-coming shift supervisors failed to conduct a proper review of the physical status of the facility and did not notice the pump covers were removed. Critique members determined that the on-coming senior reactor operators reviewed their logs but failed to recognize the pump covers were removed. They also determined the crane operator should have been aware that confinement conditions were not met and should not have moved the cask.

The facility manager is investigating this event to determine appropriate and effective corrective actions. He is considering the following corrective actions.

- Upgrading the existing status board by adding a confinement status indicator.
- Requiring retraining and recertification of the crane operator and the shift supervisors.
- Requiring senior management to observe all cask movements.

NFS reported limiting condition for operation violation events in several 1996 Weekly Summaries.

- Weekly Summary 96-32 reported that on August 2, 1996, at the Pantex Plant, a facility manager reported that the facility was shifted to an operational mode while the fire department notification system was out of service. As delineated in the Pantex Critical Safety System Manual, the fire notification system must be functional before facility operability can be declared. A facility manager erroneously used a memo written to supersede the building safety evaluation screen of another building to determine readiness for operations. Managers, supervisors, and operators must have a common understanding of operability to minimize nonconservative interpretations when determining facility operability. (ORPS Report ALO-AO-MHSM-PANTEX-1996-0168)

- Weekly Summary 96-32 reported that on August 28 and 29, 1996, at the Savannah River Site HB-Line, operators continued to operate the facility for 7 hours after the time limit for a limiting conditions for operation had expired. Maintenance technicians were repairing facility exhaust fans, causing the ventilation system to be inoperable, and placed in the facility in a limiting conditions for operation. The action statement required the operators to place the facility in warm standby. On August 29, the shift operations manager realized that the limiting conditions for operation time limit had expired and immediately placed the facility in warm standby. He was not previously aware of the limiting conditions for operation time limit because of an inadequate shift turnover. (ORPS Report SR--WSRC-HBLINE-1996-0017)

DOE 5480.22, *Technical Safety Requirements,* states that technical safety requirements means those requirements that define the conditions, safe boundaries, and the management of administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases or radioactive materials or from radiation exposures due to inadvertent criticality. The Order also states that limiting conditions for operation establish the lowest functional capability or performance levels of equipment required for normal safe operation of the facility. The Order provides guidance regarding limiting conditions for operation compliance. Implementation of the technical specifications and the limiting conditions for operation is dependent upon the on-shift operating crew at a nuclear facility.

DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter II, “Shift Routines and Operating Practices,” states that the on-duty shift supervisor maintains authority and responsibility for all facility operations. The Order also states that it is the responsibility of the on-shift operating crew to safely operate the facility through adherence to operating procedures and technical specification or operational safety requirements and sound operating practices. Chapter VIII, “Control of Equipment and System Status,” discusses the control and status of equipment and states that the operations supervisor is responsible for maintaining proper configuration. Chapter XII, “Operations Turnover,” states that shift turnover is a critical part of DOE facility operations. The Order also states that on-coming personnel should not assume operational duties until both they and the off-going personnel have a high degree of confidence that an appropriate information transfer has taken place. On-coming personnel should conduct a comprehensive review of appropriate written and visual information before responsibility for the shift is transferred. Shift turnovers should be guided by a checklist and should include a thorough review of

appropriate documents describing important aspects of facility status and an inspection of appropriate facility instrumentation.

OEAF recommends the involvement of planners, schedulers, job supervisors, and senior operations personnel to review work plans, schedules, sequences of maintenance activities, and overall requirements to avoid violation of technical specifications or a limiting condition for operation.

KEYWORDS: conduct of operations, inattention to detail, limiting conditions for operations

FUNCTIONAL AREAS: configuration control, operations, procedures, training and qualification

2. ENGINEERS FAIL TO INCLUDE CODE/STANDARD CHANGES IN SYSTEM SURVEYS AND AUDITS

This week Operating Experience Analysis and Feedback engineers reviewed an Oak Ridge lessons-learned document describing a June 26, 1996, occurrence at Y-12 Site, where a fire protection engineer discovered a paddle-type flow switch installed in a pre-action fire protection system contrary to National Fire Protection Association (NFPA) standards. Previous walk-downs of fire systems to designate them as limited condition of operability systems failed to identify this discrepancy because the walk-downs did not include a review for adherence to NFPA code changes. The as-found condition of the paddle-type flow switch resulted in an unreviewed safety question. Reviews of systems should include verification of codes and standards and identification of discrepancies associated with system configuration that could affect system operability. (Lesson Learned L-1997-OR-LMESY12-0201 and ORPS Report ORO--LMES-Y12NUCLEAR-1996-0012)

The fire protection engineer, who had not participated in previous system walk-downs, knew of the current NFPA code requirements. After the June 26 walk-down he brought the deficiency to the attention of the building manager for evaluation and corrective action. The engineer knew that the present NFPA Standard 13, “Standard for the Installation of Sprinkler Systems,” did not allow the installation of paddle-type flow switches in pre-action systems.

Engineers initiated an unreviewed safety question determination to address impact of the code violation on the existing authorization basis. They determined an unreviewed safety question existed. Fire protection engineers performed a walk-down of three additional pre-action sprinkler systems and discovered that two of them had at least one paddle-type flow switch installed. They processed a second unreviewed safety question for these flow switches. Facility managers declared the systems were inoperable and initiated compensatory measures (roving fire watches) while the fire protection systems were inoperable. After maintenance personnel removed the flow switches and tested the fire protection systems, the facility managers removed the compensatory measures before they received approval from DOE.

Investigators determined the sprinkler systems were installed as wet-pipe systems in the 1970s and were converted to pre-action systems in 1980. Paddle-type flow switches are often installed in large sprinkler systems because they provide a zoned alarm that facilitates emergency response. At the time of the conversion, NFPA Standard 13 stated that paddle-type flow switches “should only be installed in wet systems.” The word

"should" indicated a recommendation that was advisable but not mandatory. Managers decided to retain the switches, but the decision was not documented.

Revisions to the NFPA standard after 1980 changed the wording to "shall only be installed in wet systems," making this requirement mandatory. The change in the standard was driven by experience. The sudden surge of water in pre-action sprinkler systems during actuation could damage the flow switch, causing portions to break off and obstruct the piping. This type of failure can happen in any sprinkler system that has a normally empty or air-filled pipe, such as dry-pipe, deluge, or pre-action systems.

Investigators learned that the field walk-downs were limited in scope. The walk-downs were conducted only to support the designation as limited condition of operability systems for restart activities. The review of the pre-action systems did not include adherence to recent code changes and other significant discrepancies associated with system configuration. Although the drawings used in the walk-down process indicated the presence of the paddle-type flow switches, the personnel performing the walk-downs failed to recognize the switches were a significant discrepancy that could impact system operability.

Recommendations from this lesson-learned document included the following items.

- Subject matter experts should stay current on revisions to codes and standards and should evaluate changes for impacts on existing systems and facilities.

- Walk-downs, fire protection engineering assessments, and similar activities should incorporate specific instructions to review systems for significant discrepancies associated with system configuration that could affect system operability.

- Paddle-type flow switches should be removed from sprinkler systems that are normally empty or have air-filled piping to eliminate the potential for impact of the system operability. Subject matter experts should examine removed switches for missing parts. If parts are missing, an investigation must be conducted to locate the parts and ensure there are no obstructions.

- Personnel performing walk-downs, fire protection engineering assessments, and similar activities should be trained in and knowledgeable of the unreviewed safety question determination process, including the methodology for determination of an as-found condition.

- Operational restrictions (compensatory measures) imposed upon determination of an as-found condition shall not be terminated without DOE approval.

This event illustrates the importance of ensuring that system engineers and subject matter experts are knowledgeable of standards and codes that affect systems operation. Methods need to be in place to ensure systems comply with present codes and standards. Personnel can stay current with changing requirements by attending meetings conducted by standards organizations throughout the year or by electronically locating information on codes and standards on the Internet. The NFPA Internet address is www.wpi.edu/~fpe/nfpa.html. Information on ordering NFPA documents can be obtained by contacting the NFPA at (800) 344-3555. This event also identified a weakness with the

familiarity of the unreviewed safety question determination process. DOE 5480.21, *Unreviewed Safety Questions*, sets forth the definition and basis for determining the existence of an unreviewed safety question. Each facility must develop procedures to implement the unreviewed safety question review process consistent with the provisions described in the Order. Paragraph 10.d of the Order requires that a completed safety evaluation be submitted to DOE before any operational restrictions (compensatory measures) are removed.

KEYWORDS: fire protection, sprinkler, unreviewed safety question

FUNCTIONAL AREAS: fire protection, licensing compliance

3. INADEQUATE WORK PLANNING RESULTS IN RADIATION EXPOSURE TO OPERATOR'S HANDS

On February 24, 1997, the Idaho National Engineering Laboratory Test Reactor Area Hot Cell facility manager reported that on December 17, 1996, a hot cell facility operator received an extremity dose of 3.15 rem to his right hand and 1.1 rem to his left hand while moving an irradiated sample from a hot cell into a lead cask. The exposure occurred when the operator touched the irradiated sample to slide it into the cask. The operators were working with samples that differed from previous samples and had higher radiation levels. The operator wore extremity dosimetry on both hands and was continuously monitored by a radiological control technician. Investigators determined that inadequate planning resulted in the extremity exposure. Investigators also determined that the delay in the processing of extremity dosimetry created the potential for exceeding extremity dose limits. Failure to properly evaluate new processes and plan accordingly resulted in an unnecessary exposure. (ORPS Report ID--LITC-TRA-1997-0005)

An independent contractor operates the Test Reactor Area Hot Cell, and radiological control technicians are supplied by the management and operations contractor. Investigators determined that the previous samples removed from the hot cell were partial targets that were irradiated. However, this sample was a full target and had a higher radiation level than the partial targets. Investigators alsodetermined the operator handled the sample without conducting a proper radiation survey. They also determined that neither contracting company adequately reviewed methods for handling and removing the sample or calculated expected radiation levels. Investigators also determined the current dosimetry program does not ensure timely processing of extremity dosimetry. This resulted in about a 1-month delay in processing the results for this event, and the employee could have exceeded extremity limits before his actual dose was determined.

The hot cell facility manager directed the following corrective actions.

- The hot cell facility managers designed a special transfer device to facilitate removal of samples from the cell, and the management and operations maintenance group fabricated it.

- The hot cell general manager retrained the hot cell facility operators. Training included (1) a review of general as low as reasonably achievable principles, (2) fundamentals of minimizing radiation exposure, (3) recent exposure events at other DOE facilities, (4) a review of the fundamentals of radiation field variability with source strengths/shielding, (5) point source

calculations, (6) company policy regarding the necessity for extremity exposure, and (7) transfer operations.

The radiological control manager for the management and operations contractor revised the radiation work permit and directed hot cell facility operators to handle samples with tools, not their hands. The revision also requires radiological control technicians to prohibit access to areas where radiation surveys have not been conducted. He will evaluate the Test Reactor Area dosimetry program and modify it to ensure the timely tracking of extremity exposures. The radiological control manager will review the radiological control technician qualification standards for the hot cell area to determine their adequacy. The radiological control manager also directed the following corrective actions.

- Radiological Engineering personnel will evaluate hot cell radiological activities and recommend appropriate changes, as necessary.

- Radiological Engineering personnel will perform dose-rate calculations for current and future isotope operations before initiation of actual process operations.

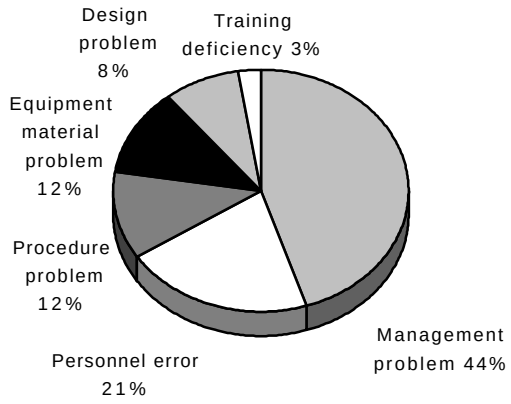
- A radiological control supervisor will approve all radiation work permits when extremity exposures greater than 500 mrem are expected.

NFS reported work planning issues in 38 Weekly Summaries in 1996. Weekly Summaries 96-15 and 96-09 reported an uptake and an extremity exposure because of inadequate work planning.

- Weekly Summary 96-15 reported that on April 2, 1996, Los Alamos National Laboratory reported that a safeguards, science and technology design physicist received a whole-body dose of 207 mrem from a californium-252 source when he repaired the jammed teleflex cable that moves the source in and out of a shield. The cable jammed in a position that left the source unshielded. Because the exposed source was a radiation hazard, the physicist and a co-worker decided to repair the apparatus without proper work planning or radiological controls support. The physicist's supervisor was unaware of his abnormal dose reading for 2 months, until the dosimeter was processed. The physicist was successful in restoring the source to its shielded storage position, but his failure to properly plan the work resulted in unnecessary radiation exposure. (ORPS Report ALO-LA-LANL-CMR-1996-0015)

- Weekly Summary 96-09 reported that on February 26, 1996, an operator at the Hanford B Plant received radiation exposure greater than pre-job estimates while working in a valve pit to remove water from an underground, isolated, and out-of-service HEPA filter. The operator stayed in the pit longer than anticipated and his self-reading dosimeter was off-scale low, indicating an anomaly. Radiological control technicians pulled his dosimetry and restricted him from radiological area access pending the reading of his TLD. The operators actual exposure of 273 mrem was greater than the expected dose of 200 mrem but less than the 500 mrem per year administrative control level. Detailed pre-job planning could have limited exposure to less than the pre-job estimates. (ORPS Report RL--WHC-BPLANT-1996-0002)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for radiation exposure and found 214 occurrences. Figure 3-1 shows facility managers reported management problems as the root cause for 44 percent of radiation exposure events across the DOE complex. Thirty-nine percent of the management problems were the result of inadequate administrative control. Eleven percent of the management problems were the result of work organization or planning deficiencies.



Management Problem	Percent
Inadequate administrative control	39
Other management problem	33
Policy not communicated or enforced	14
Work organization/ planning deficiency	11
Inadequate supervision	3

Figure 3-1. Distribution of Root Causes for Radiation Exposures Across the DOE Complex[1]

DOE/EH-0256T, *Radiological Control Manual,* chapter 1, emphasizes the DOE radiological control policy is based on adherence to as low as reasonably achievable principles and on ownership, where each person is expected to demonstrate responsibility and accountability toward radiation and radioactivity. Chapter 3 states that technical work documents, such as procedures, are to be used to control hands-on work with radioactive materials. Section 313, "Infrequent or First-Time Activities," states that special management attention should be directed to radiological activities that are infrequently conducted or represent first-time operations. This section also provides guidance on planning activities. Section 641 stresses that training should not only include routine operations but should also focus on recognizing and handling situations in both normal and changing radiological conditions. Sections 642 through 644 specify the training requirements for radiological control technicians and supervisors. Radiological control managers should review this event and the applicable sections of their site-specific manual to reduce the possibility of a similar event.

KEYWORDS: extremity exposure, radiation protection, radioactive material, work planning

FUNCTIONAL AREAS: radiation protection, work planning

[1] OEAF engineers screened the ORPS database for Nature of Occurrence "4A@" (radiation exposure) and found 214 occurrences.

4. PERSONNEL IDENTIFY NONFUNCTIONAL SELF-CONTAINED BREATHING APPARATUS WHILE RESPONDING TO A FREON® RELEASE

On February 24, 1997, at the Idaho National Engineering Laboratory, personnel responding to an accidental release of Freon® (R-22) in an auxiliary equipment room at the Advanced Test Reactor identified three nonfunctional self-contained breathing apparatus units. Following the release, personnel could not connect the regulators to the face masks on three of six units. The release of 410 pounds of Freon® occurred when metal scaffolding broke off a pressure tap (Schraeder valve) from the top of a chiller unit while carpenters were dismantling the scaffold. Safety equipment, such as self-contained breathing apparatus, must be maintained in working order to support facility operations and casualty situations. (ORPS Report ID--LITC-ATR-1997-0006)

To prevent formation of phosgene gas that can be produced from heated Freon®, the shift supervisor stopped all welding and other work in the building that could produce an open flame. The National Institute for Occupational Safety and Health (NIOSH) guidelines state that a phosgene concentration of 2 ppm is immediately dangerous to life or health, as compared to 30 ppm chlorine. The material safety data sheet for Freon® states that it is a very heavy gas that can sink and collect in building low spots. The shift supervisor cleared all personnel from lower floors in the building. Personnel wearing self-contained breathing apparatuses performed checks in the accessible basement areas to ensure no one remained in these areas.

After discovering problems with the three self-contained breathing apparatus units, environment, safety, and health personnel inspected the remaining units. They identified 2 additional units with the same problem, resulting in a total of 5 nonfunctional units out of 21. Investigators determined that new Mine Safety Appliances Company self-contained breathing apparatus with upgraded masks and regulators were received at the facility. The upgraded components are not 100 percent interchangeable with regulators and mask assemblies from older units that have not been upgraded. Investigators believe industrial hygiene personnel may have interchanged masks and regulators when placing them in storage cases, making those units unusable.

NFS reported other safety issues regarding self-contained breathing apparatus in Weekly Summaries 96-48, 95-36, and 94-30.

- On October 2, 1996, Brookhaven National Laboratory safety personnel reported that a quick-operating connection on a face mask for a self-contained breathing apparatus failed during confined space training. The failure occurred inside the air mask at the air supply connection. The air line fell off when a plastic threaded flange split along the threads. This allowed the air tank to discharge to the environment through the low-pressure supply line. Brookhaven safety personnel contacted the manufacturer, CairnsAir, L.L.C., who replaced the quick-operating connections on all of the Laboratory's self-contained breathing apparatus face masks. (Weekly Summary 96-48; ORPS Report CH-BH-BNL-BNL-1996-0016)

- On August 24, 1995, maintenance personnel at Rocky Flats discovered deficiencies on four air line hoses while performing final checks of supplied-air

respiratory equipment before entering a plutonium component storage area. One hose completely separated from the crimped fitting; the other three failed leak-test criteria. Investigators believe the deficient hoses were manufactured on site using parts from older hoses. Although there was a vendor stamp, local manufacture of the hoses could not be discounted because the failed hoses did not contain a key manufacturer identifier. (Weekly Summary 95-36; ORPS Report RFO-KHLL-PUFAB-1995-0018)

- On May 16,1994, the Nuclear Regulatory Commission issued Information Notice 94-35 on problems with inadvertent separation of the mask-mounted regulator from the facepiece on the Mine Safety Appliances Company self-contained breathing apparatus. Mine Safety Appliances Company identified three factors that can lead to regulator separation: (1) lack of lubrication of the facepiece adapter O-ring, (2) dirt and debris in the quick-connect mechanism, and (3) ice formation in the quick-connect mechanism during cold weather use. On March 31, 1994, NIOSH issued a status update that described a Neckstrap/Regulator-Retainer Kit by Mine Safety Appliances Company and accepted by NIOSH. This retainer, when properly installed, provides a lock for the regulator-to-facepiece connection. (Weekly Summary 94-30; NRC Information Notice 94-35)

Facility safety personnel and industrial hygienists who maintain self-contained breathing apparatus should ensure that the regulators and face-mask assemblies are stored as compatible units. Care should be exercised to prevent interchanging noncompatible components.

NFS encourages managers to incorporate lessons learned from other organizations and to take these lessons into account in their programs. Lessons learned are valuable only if the information that is shared is used. DOE-STD-7501-95, *Development of DOE Lessons Learned Programs*, was designed to promote consistency and compatibility across programs. Both lessons learned and program managers should review the standard and incorporate applicable elements into their site programs. Managers, supervisors, and operators should review lessons learned documents for applicability, and the information should be used to improve operations.

KEYWORDS: safety, self-contained breathing apparatus

FUNCTIONAL AREAS: industrial safety

ADDITIONAL INFORMATION ON FOLLOW UP ACTIVITIES

1. CLARIFICATION OF WEEKLY SUMMARY 97-07, OEAF ACTIVITY, ARTICLE 1, ANALYSIS OF NUCLEAR MATERIAL INVENTORY STORAGE VIOLATIONS

In the article, Operating Experience Analysis and Feedback Engineers stated on page 12 that DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques For Compliance With DOE Order 5480.23, Nuclear Safety Analysis Reports*, provides

guidance for determining the hazard category of a facility. Feedback from DOE facilities warrants further clarification of this statement. Personnel at DOE facilities can use the threshold values for the quantities of the various nuclides listed in the standard to determine the initial hazard category for the facility. According to the standard, a facility initially assigned as a hazard category 1, 2, or 3, requires a final safety evaluation in accordance with DOE Order 5480.23. The final safety evaluation can be used to change the hazard categorization of the facility from the initial radionuclide-quantity-based categorization.

On page 16, OEAF engineers discuss increasing the margin of safety "by placing barriers in parallel." The correct terminology is placing barriers in series.